C0-IR
Preparatory Work 2007 (WBS 2.10)
Preparatory Work 2008 (WBS 2.8)
Reconfiguration 2009 (WBS 2.11)

Rob Reilly (WBS 2.10)

(WBS 2.8) & (WBS 2.11)

Overview

- Introduction and overview of the 2007, 2008 and 2009 Shutdowns
- WBS 2.10 – Preparation 2007
  - Begin LCW and Bus Work
- WBS 2.8 – Preparation 2008
  - Complete LCW and Bus Work
  - Install Compensating Dipole Handling Equipment
  - Remove Q1 and TSP spools from A49 and B11
- WBS 2.11 – Reconfiguration to Low Beta Straight Section 2009
  - Converting from Normal Straight to Low Beta Straight

- LCW and bus work is begun during this shutdown
- LCW and bus will be fed off the Tevatron into the C-0 Service Building

Base obligation: $.45M (Material: $.42M, Labor: $.03M)

- LCW and bus work is completed during this shutdown.
- The compensating dipoles are inside the BTeV toroids. To change them in the event of a failure, handling equipment is provided in the Tevatron tunnel on either side of the IR Hall, installed this shutdown.
- The Q1 quads and TSP spools at A49 and B11 must be removed for use in the C0-IR, and spacers installed in their places.

Base obligation: $.65M (Material: $.49M, Labor: $.16M)

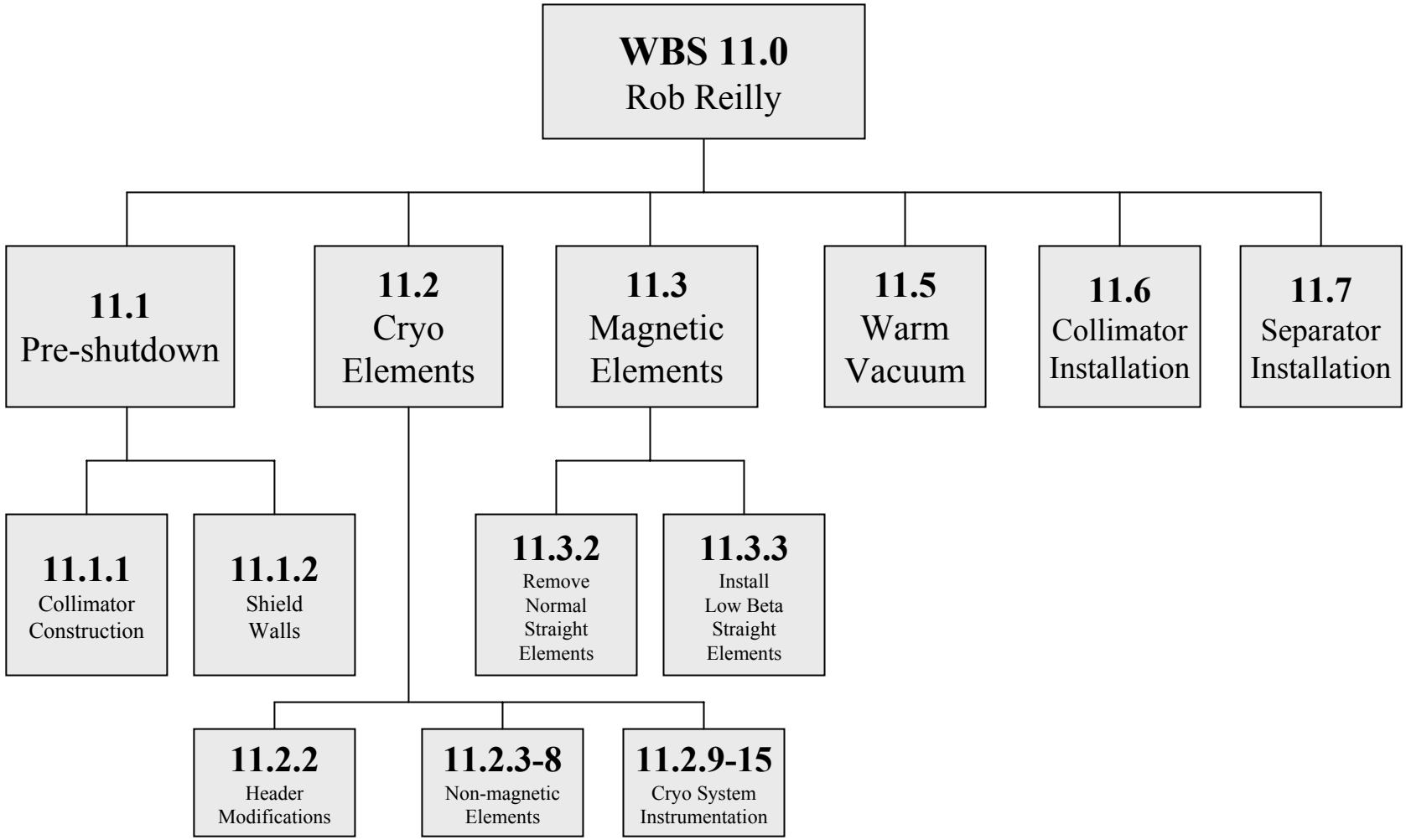
2009 Shutdown WBS 2.11

- Warm up houses B4 and C1
- Remove all remaining old Main Ring magnets out of the tunnel
- Remove 12 quad magnets, 14 spools and 5 non-magnetic cryo devices out of the tunnel
- Move 23 dipole magnets out of the way
- Rework cryogen quench headers
- Build 2 movable concrete shield walls
- Install 23 dipoles, 10 LHC quads, 4 TeV Q1 quads, 10 X spools, 4 P spools and 9 non-magnetic cryo devices
- Cool down houses B4 and C1
- Install 6 separators, 2 collimators
- Connect warm vacuum to BTeV
- Close shield walls

Base obligation: $1.83M (Material: $.63M, Labor: $1.20M)

Organization WBS 2.11

Base obligation: $1.83M (Material: $.63M, Labor: $1.20M)

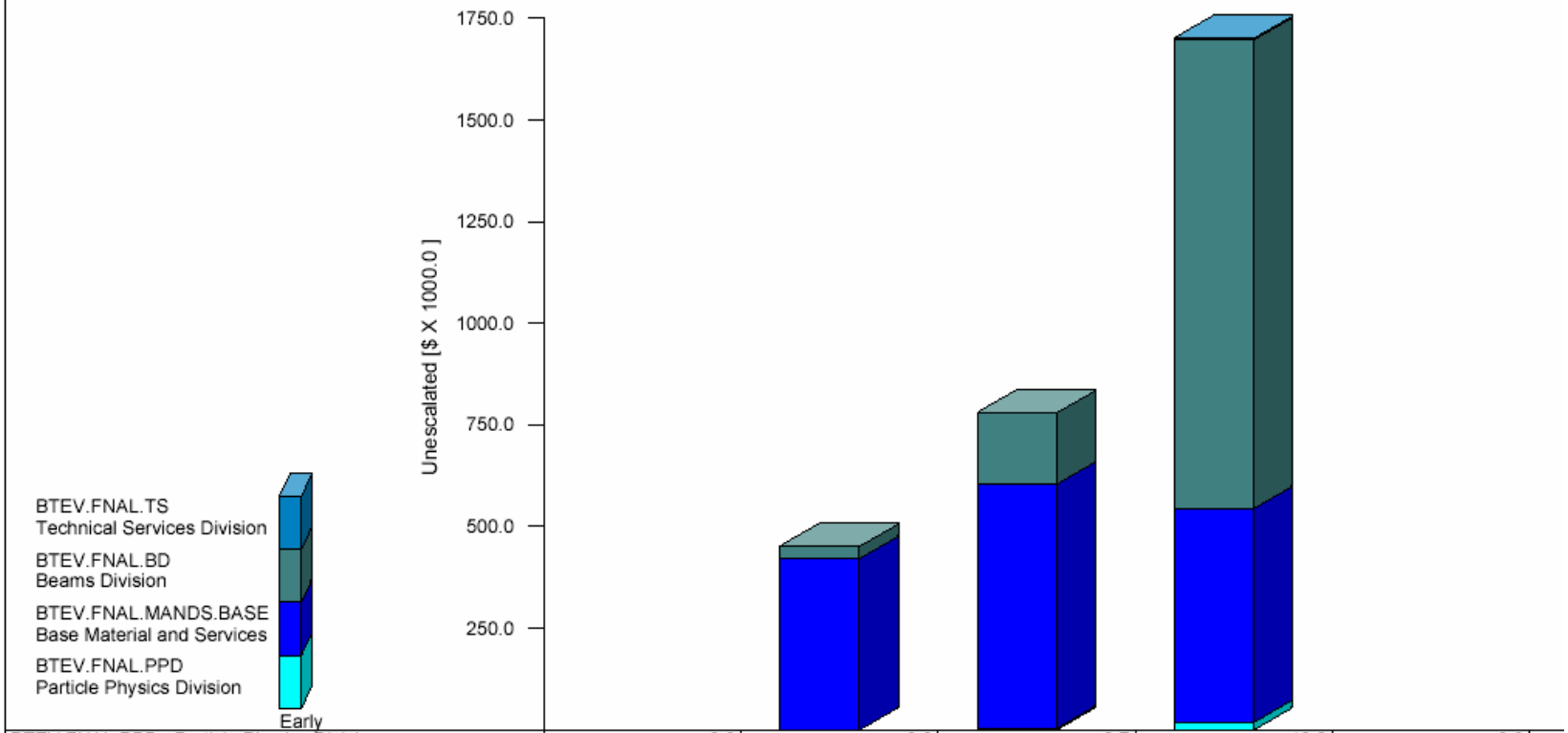


Construction Obligation Breakdown WBS 2.8, 2.10, 2.11

WBS	Subproject	M&S (K$)	labor (K$)	total (K$)
2.8.1	2008 shutdown planning/procurement	313.2	24.6	337.8
2.8.2	Removal of Q1/TSP from A4,B1	15.1	84.1	99.2
2.8.3	Collimator removal from F17,E0	0.0	4.2	4.2
2.8.4	LCW and buswork	162.4	42.7	205.1
2.10.1	2007 shutdown planning/procurement	290.0	3.2	293.2
2.10.2	lcw and buswork	133.4	28.2	161.6
2.11.1	2009 shutdown planning/procurement	104.4	148.2	252.6
2.11.2	cryogenic elements	511.1	165.3	676.4
2.11.3	magnetic elements	0.0	870.8	870.8
2.11.8	instrumentation modifications	13.9	12.3	26.2
	Total	**1543.5**	**1383.6**	**2927.1**

Total Obligation Profile by Fiscal Year WBS 2.8, 2.10, 2.11

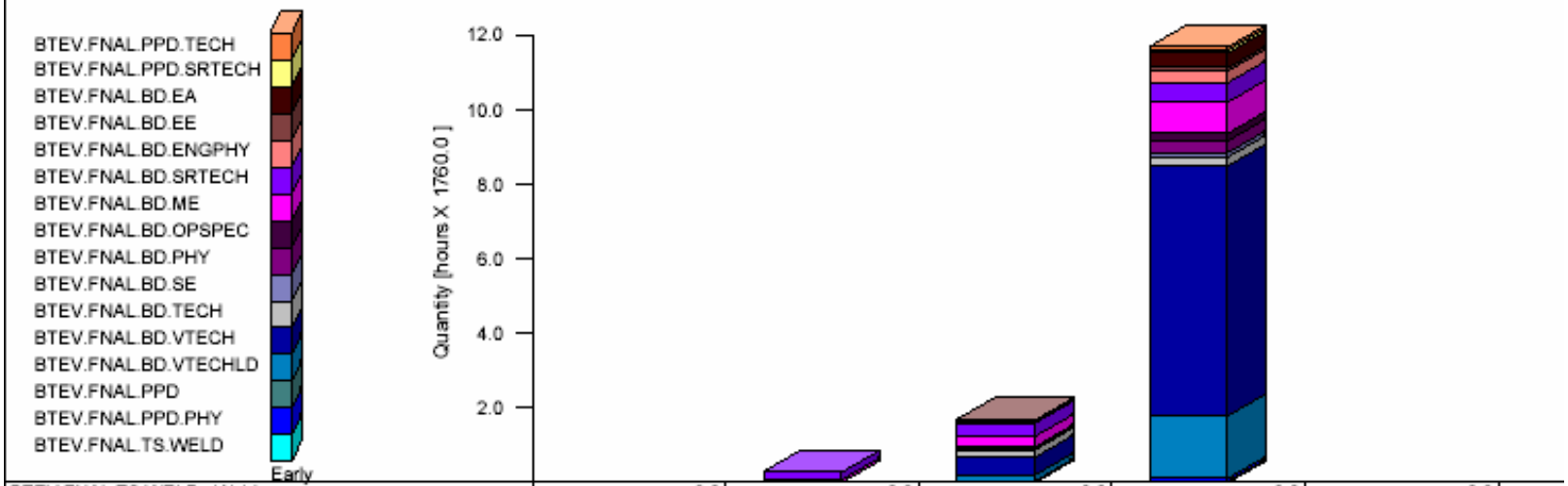
Activity ID	Activity Description	FY06	FY07	FY08	FY09	FY10
8	2008 Shutdown			8		
10	2007 Shutdown		10			
11	2009 shutdown			11		



BTEV.FNAL.PPD : Particle Physics Division	0.0	0.0	2.7	16.2	0.0	
BTEV.FNAL.MANDS.BASE : Base Material and Services	0.0	420.1	598.4	525.0	0.0	
BTEV.FNAL.BD : Beams Division	0.0	30.7	175.6	1156.5	0.0	
BTEV.FNAL.TS : Technical Services Division	0.0	0.0	1.1	0.8	0.0	

Labor Profile by Fiscal Year (FTE's) WBS 2.8, 2.10, 2.11

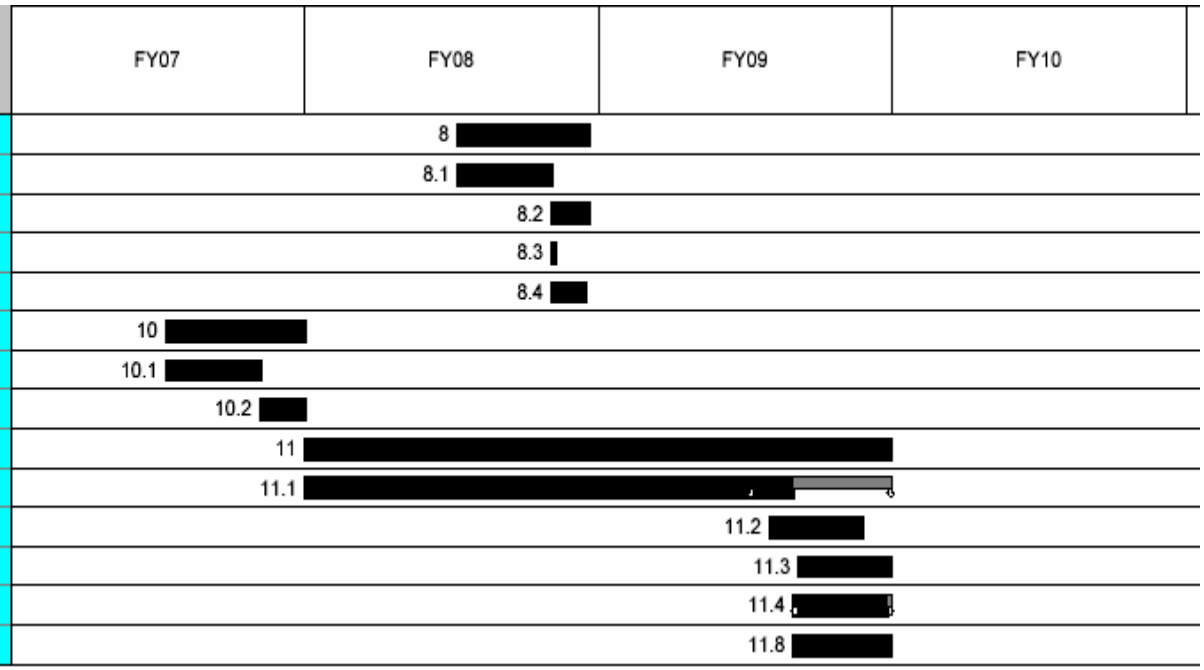
Activity ID	Activity Description	FY06	FY07	FY08	FY09	FY10
8	2008 Shutdown			8		
10	2007 Shutdown		10			
11	2009 shutdown			11		



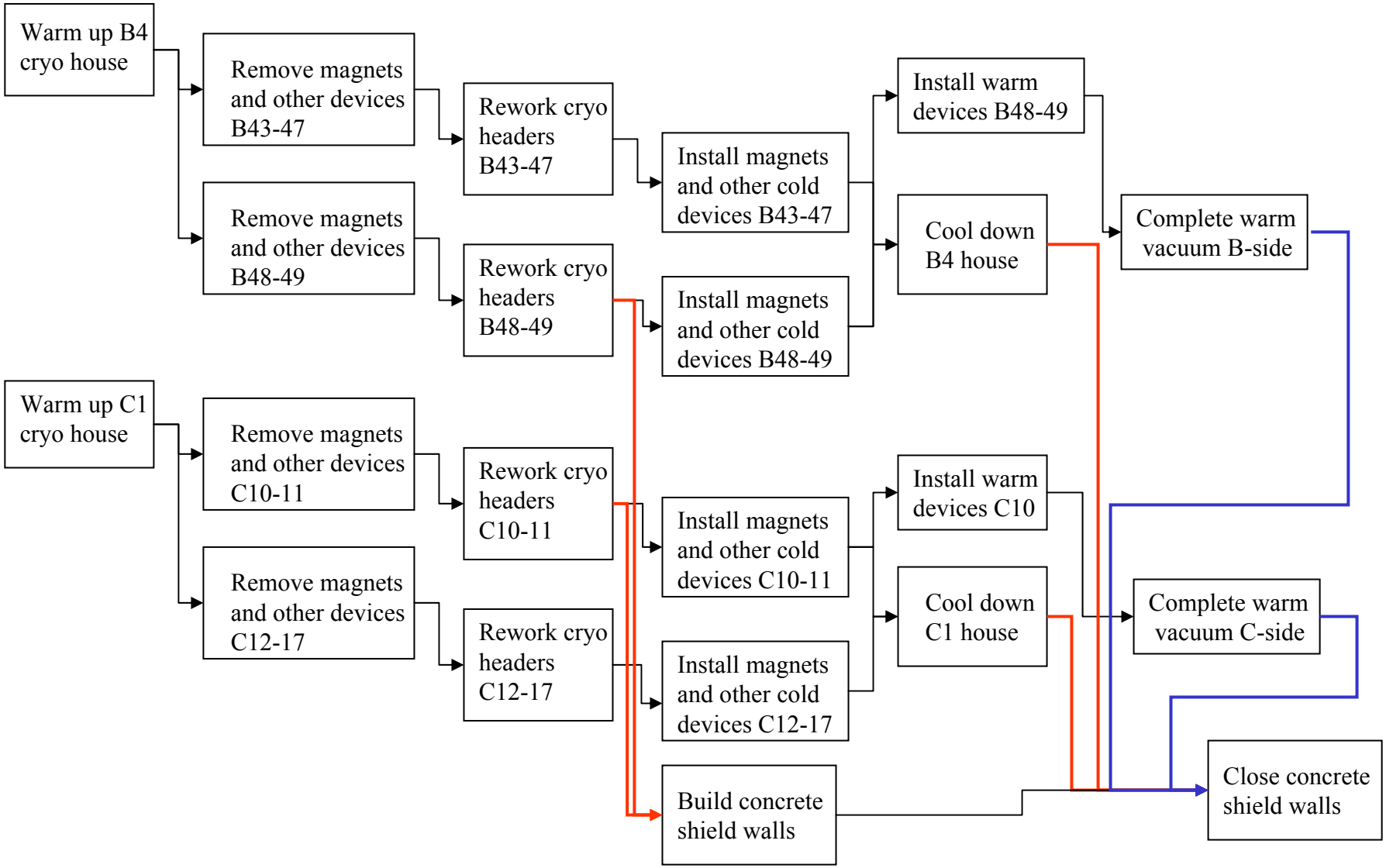
BTEV.FNAL.TS.WELD : Welder	0.0	0.0	0.0	0.0	0.0	
BTEV.FNAL.PPD.PHY : Physicist	0.0	0.0	0.0	0.1	0.0	
BTEV.FNAL.PPD : Particle Physics Division	0.0	0.0	0.0	0.0	0.0	
BTEV.FNAL.BD.VTECHLD : Vacuum Technician Leader	0.0	0.0	0.1	1.7	0.0	
BTEV.FNAL.BD.VTECH : Vacuum Technician	0.0	0.0	0.5	6.7	0.0	
BTEV.FNAL.BD.TECH : Technician	0.0	0.0	0.2	0.3	0.0	
BTEV.FNAL.BD.SE : Software Engineer	0.0	0.0	0.0	0.1	0.0	
BTEV.FNAL.BD.PHY : Physicist	0.0	0.0	0.0	0.3	0.0	
BTEV.FNAL.BD.OPSPEC : Operations Specialist	0.0	0.0	0.0	0.2	0.0	
BTEV.FNAL.BD.ME : Mechanical Engineer	0.0	0.1	0.3	0.8	0.0	
BTEV.FNAL.BD.SRTECH : Senior Technician	0.0	0.2	0.4	0.5	0.0	
BTEV.FNAL.BD.ENGPHY : Engineering Physicist	0.0	0.0	0.1	0.3	0.0	
BTEV.FNAL.BD.EE : Electrical Engineer	0.0	0.0	0.0	0.1	0.0	
BTEV.FNAL.BD.EA : Engineering Associate	0.0	0.0	0.0	0.4	0.0	
BTEV.FNAL.PPD.SRTECH : Senior Technician	0.0	0.0	0.0	0.1	0.0	
BTEV.FNAL.PPD.TECH : Technician	0.0	0.0	0.0	0.1	0.0	

Schedule WBS 2.8, 2.10, 2.11

Activity ID	Activity Description
8	2008 Shutdown
8.1	2008 shutdown preparation
8.2	Removal/replacement of Q1/TSP from A4/B1
8.3	Remove collimator stands from F17 and E0
8.4	LCW and buswork
10	2007 Shutdown
10.1	2007 Shutdown Preparations
10.2	LCW and buswork
11	2009 shutdown
11.1	Preshutdown planning and fabrication
11.2	Cryogenic elements
11.3	Magnetic elements
11.4	LCW modifications, including buswork
11.8	Instrumentation modifications



Description of Project Flow WBS 2.11



- WBS 2.10 Shutdown 2007
  - Fixed Price Contract awarded, contractors trained
  - LCW and bus materials at hand
- WBS 2.8 Shutdown 2008
  - Compensating Dipole handling equipment delivered, safety approvals complete
- WBS 2.11 Shutdown 2009
  - Stands, vacuum items, handling equipment ready
  - Concrete shielding walls M&S ready

Critical Path Analysis WBS 2.11

- Total shutdown length is 4 months (80 days)
- Warm up houses (Total Float = 1 days)
  - Warm-up begins first day of shutdown and is completed in 5 days. No work on cryo devices before end of this task.
- Remove cryo devices (TF = 1 days)
  - Removal begins after warm-up and is completed in 15 days. Each side (B4 & C1) is separate and proceeds independently.
- Rework cryo headers (TF = 1 Days)
  - Each side (B4 & C1) begins after the cryo devices are removed and proceeds independently, estimate 15 days.
- Install cryo devices (TF = 2 Days)
  - Each side (B4 & C1) begins after most of the header work on that side is complete, and proceeds independently of the other side, estimate 30 days.
- Install separators, collimators & warm vacuum connections to BTeV (TF = 2 Days)
  - Three tasks proceed in parallel, estimate 13 days.
- Cool down houses (TF = 2 Days)
  - Each side proceeds independently in parallel, estimate 6 days.
- No overtime or weekend work scheduled
- Current task estimate critical path is 71 days (subject to refinement), leaving 9 days float.
- However, tasks are sequential within local areas, but work in different areas can proceed on parallel critical paths, so float is distributed over all tasks.
- All tasks can be completed within the 4 month shutdown.
- Preliminary task analysis indicates that a 4 month shutdown is adequate to install the C0 IR components, but a more detailed task breakdown is required to confirm this.

Risk Analysis WBS 2.8, 2.10, 2.11

Risks	Mitigation
LCW or bus materials late	Orders placed early to ensure on time delivery
Compensating Dipole Handling Equipment materials late	Install during intermediate shutdowns
Magnets, spools, other cryo devices late	Shuffle tasks as devices become available
Vacuum techs scarce	Contingency is overtime and weekends

Summary for WBS 2.10, WBS 2.8 and WBS 2.11

WBS 2.10

- Overview – Rob Reilly
- LCW and Bus Work – John Riordan

WBS 2.8

- Overview – Rob Reilly
- LCW and Bus Work – John Riordan
- Compensating Dipole Handling Equipment – Rob Reilly
- Removal of Q1 and TSP spools – Rob Reilly

WBS 2.11

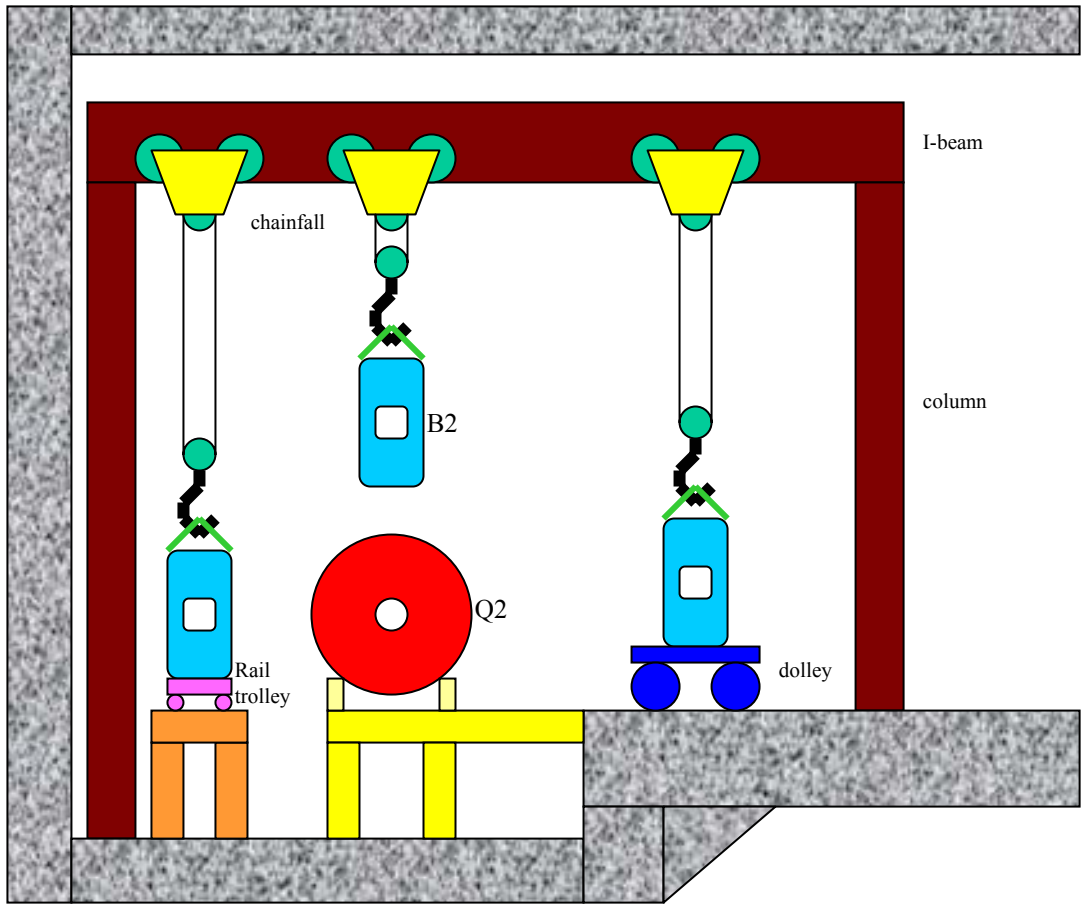
- Overview – Rob Reilly
- Shield Walls – Rob Reilly
- Cryogenic Elements – Jay Theilacker
- Header Modifications – Jay Theilacker
- Magnetic Elements – Rob Reilly
- Vacuum Modifications – Rob Reilly
- Collimator Installation – Rob Reilly
- Separator Installation – Rob Reilly
- Instrumentation – Randy Thurman-Keup

Glossary of Terms

- Magnetic Device – cryo dipoles, quads, powered spools
- Non-Magnetic Device – unpowered spools, bypasses
- LCW – low conductivity water system
- Bus – water cooled electrical bus
- Spool – cryo device for miscellaneous functions
- Bypass – cryo device providing a short warm vacuum slot for warm vacuum devices, around which the cryogens bypass
- Cryogens – liquid nitrogen @77^{o}K and liquid helium @4^{o}K
- House – a Tevatron magnet string all on one isolated cryo system
- Warmup – bringing a cryo house up to room temperature
- Cooldown – bringing a cryo house down first to 77^{o}K, then to 4^{o}K
- Warm Vacuum Device – any beamline device not in the cryogenic system, e.g. separators, collimators

Compensating Dipole Handling Equipment WBS 2.8

The magnet is pulled out of the toroid on a rail trolley alongside the beamline, then lifted by two chainfalls on parallel I-beams and traversed over the Q2 quad, set on dolleys and removed from the tunnel.



No Scale

B-side looking downstream

C-side opposite